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PROFESSOR HERO III

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

UNIVERSITY OF MICHIGAN
ELECTRICAL ENGINEERING & COMPUTER SCIENCE
ANN ARBOR, MI 48109-2122

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13. ABSTRACT *(Maximum 200 words)*

This is the final report on research activity on the AFOSR AASERT grant P49620-98-0370 during the period beginning to end. The AASERT grant has permitted Professors Hero and Teneketzis to provide student RA support on the parent APOSR MURI grant F49620-96-0028. The grant has supported three graduate students, Robby Gupta, Chris Lott and Thomas Kragh, on an alternating semester-by-semester basis (25% RA support by AFOSR supplemented by 25% support by other sources). Robby Gupta and Chris Lott completed their Ph.D. dissertations in their respective directions: (1) interaction between spatial resolution and detection/classification performance for automated target recognition; and (2) sequencing, scheduling, and resource allocation associated with the sensor management and distributed operation of an automated target recognition system. Thomas Kragh will complete his Ph.D. thesis defense in July 2002.

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Detection and Resource Allocation Problems in ATR Systems

AFOSR AASERT, Grant # F49620-98-1-0370

PI's: Alfred Hero and DemosthenisTeneketzis

The University of Michigan
Electrical Engineering and Computer Science
1301 Beal Avenue
Ann Arbor, MI 48109-2122

Final Report

Period covered: 4/1/98 – 3/31/02

1. Objectives

This AASERT grant partially supported three graduate students, each working on one of two classes of related problems: (1) robust detection for multi-resolution automated target recognition; and (2) sequencing, scheduling, and resource allocation associated with the sensor management and distributed operation of an automated target recognition system. The students working on robust detection were supervised by Professor Hero; the student working on resource allocation and sequencing problems were supervised by Professor Teneketzis.

2. Status of effort

This is the final report on research activity on the AFOSR AASERT grant F49620-98-0370 during the period beginning to end. The AASERT grant has permitted Professors Hero and Teneketzis to provide student RA support on the parent AFOSR MURI grant F49620-96-0028. The grant has supported three graduate students, Robby Gupta, Chris Lott and Thomas Kragh, on an alternating semester-by-semester basis (25% RA support by AFOSR supplemented by 25% support by other sources). Robby Gupta and Chris Lott completed their Ph.D. dissertations in their respective directions: (1) interaction between spatial resolution and detection/classification performance for automated target recognition; and (2) sequencing, scheduling, and resource allocation associated with the sensor management and distributed operation of an automated target recognition system. Thomas Kragh will complete his Ph.D. thesis defense in July 2002.

3. Students Supported

Robby Gupta   Graduate student research assistant working under the
                     supervision of Professor Alfred Hero.

Robby Gupta was supervised by Al Hero and graduated with his Ph.D in May 2001. In addition to his PhD thesis, one refereed journal publication has been submitted to the *IEEE Trans, on Information Theory* describing work related to this grant. This work is discussed in more detail in the final report on the AFOSR parent grant F49620-96-0028. Robby Gupta is employed at TRW, Los Angeles, California.

Thomas Kragh,   Graduate student research assistant working under the
                     supervision of Professor Alfred Hero.

Thomas Kragh was supported on the grant during the last semester of the grant (ending in March 2002) during which time he worked on extensions of Robby Gupta's optimal vector quantization work. These extensions included optimal quantization for inverse problems and specifically optimal binning of tomographic projections (sensor surfaces) for the express purpose of target detection. He will defend his thesis in July 2002. In addition to his PhD thesis, a conference paper will appear at Asilomar in Nov. 2002, and a full length paper on this work is in preparation

for submission to the *IEEE Transactions on Image Processing*.

Chris Lott   Graduate student research assistant working under the
                       supervision of Professor Demosthenis Teneketzis.

Chris Lott was supervised by Demos Teneketzis. Chris received his Ph.D degree in February 2001. His research resulted in 4 journal papers (one of which has been published and three are currently under review) and 4 refereed conference publications (see list of publications). The work documented in the aforementioned papers is discussed in more detail in the final report on the AFOSR parent grant F49620-96-0028. Chris Lott is currently employed by Qualcomm in San Diego, California.

4. List of Publications

R. Gupta and A. O. Hero, "High rate vector quantization for detection," submitted to *IEEE Trans. on Info Theory*, Sept. 2001.

T. Kragh and A. O. Hero, "Optimal bit allocation for detection in large scale tomographic systems" in preparation, July 2002.

T. Kragh and A. O. Hero, "Emission Tomography from compressed list-mode data," to appear in the Proc. of *IEEE Asilomar Conference on Sig, Syst., and Comm.*, Pacific Grove CA, Nov. 2002.

C. Lott and D. Teneketzis, "On the Optimality of an Index Rule in Multichannel Allocation for single-Hop Mobile Networks with Multiple Message Classes," *Probability in the Engineering and Informational Sciences*, Vol. 14, 2000, pp. 259-297.

C. Lott and D. Tenekeketzis, 'On the Optimality of an Index Rule in Channel Allocation for Single-hop Networks with Multiple Service Classes and Server Swiching Costs," submitted to *Probability in the Engineering and Informational Sciences* (revised).

C. Lott and D. Teneketzis, "Stochastic Routing in Ad-Hoc Wireless Networks I: Model and Optimal Policy Structure," submitted to *IEEE/ACM Transactions on Networking* (revised).

C. Lott and D. Teneketzis, "Stochastic Routing in Ad-Hoc Wireless Networks II: Distributed Algorithms," submitted to *IEEE/ACM Transactions on Networking* (revised).

C. Lott and D. Teneketzis, "Multi-channel Allocation in Single-Hop Networks with Priorites," Proceedings of the 38th *IEEE Conference on Decision and Control*, Phoenix, Arizona, December 1999 pp. 3550-3555.

C. Lott and D. Teneketzis, "Stochastic Dynamic Routing in Ad-Hoc Networks," Proceedings of the 39th *IEEE Conference on Decision and Control*, Sydney, Australia, December 2000, pp. 2302-2307.

C. Lott and D. Teneketzis, "Optimal Routing in Ad-Hoc Wireless Networks," *Proceedings of the IEEE 2001 Sarnoff Symposium,* The College of New Jersey, March 2001, pp. 16-19.

C. Lott and D. Teneketzis, "Optimal Routing Algorithms in Ad-hoc Wireless Networks," *Proceedings of the Thirty-Eight Annual Allerton Conference on Communication, Control and Computing,* Urbana, Illinois, October 4 – 6, 2000, pp. 123-132.